

**NDIA / TACOM-ARDEC**  
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**Symposium and Exhibition**  
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# Agenda



- **Excalibur Description**
- **Merger With TCM Program**
- **Technical Status**
- **Army/Navy Cooperation**
- **Program Schedule**





# Why Excalibur?



- **Excalibur transforms Legacy & Interim Forces –**
  - Precision strike
  - Extended range
  - Reduced collateral damage
  - Increased survivability
  - Reduced logistics footprint
- **Excalibur is an Objective Force enabler**
  - Munition for a possible 155mm NLOS FCS variant
  - Precision guidance technology carrier



# Concept of Operations



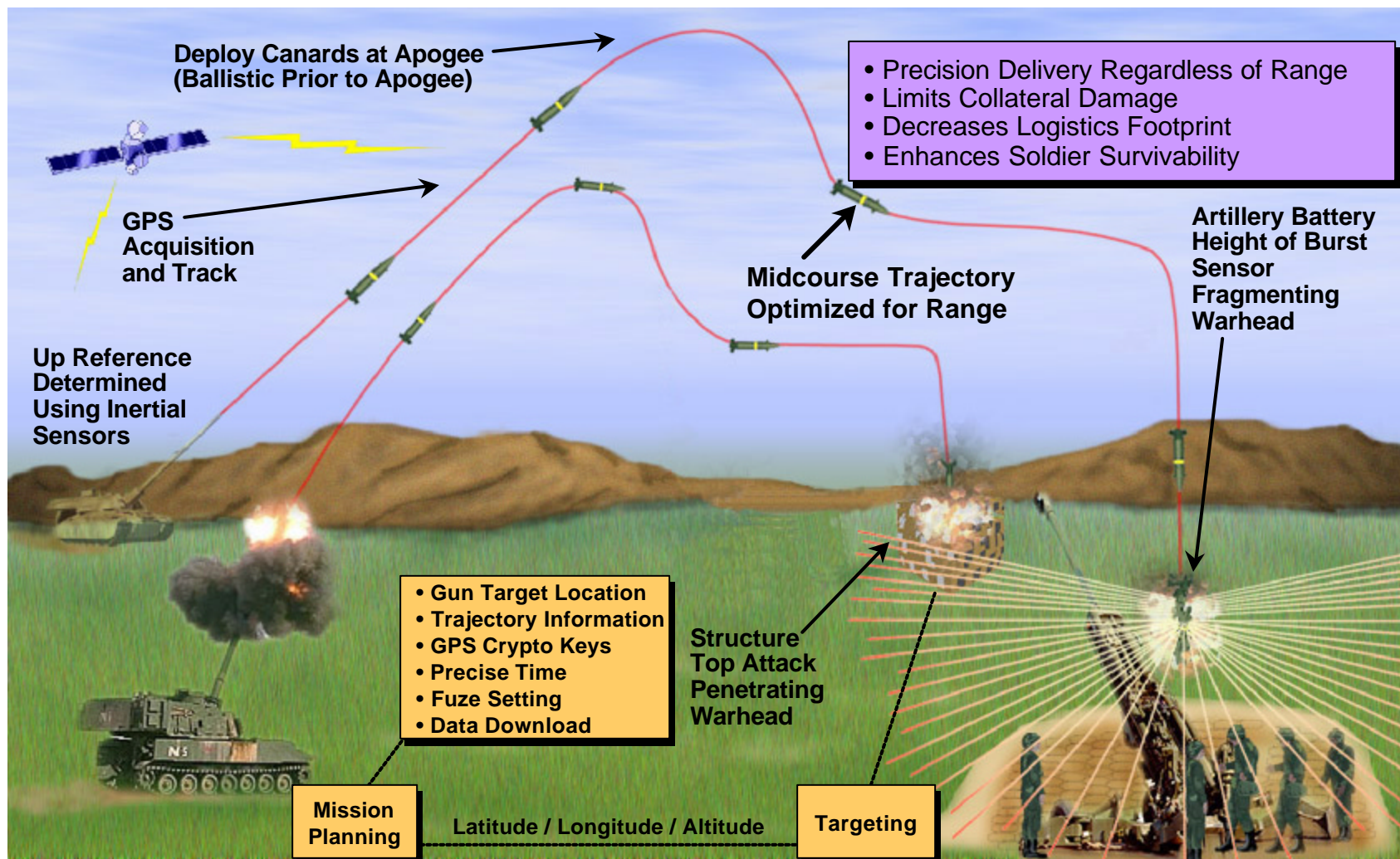
*Excalibur  
Precision Guided  
Extended Range 155mm  
Projectile*







# Concept of Operations



***Unitary Warhead XM982 Is Designed To Meet User Needs***



# System Overview



## **MISSION:**

Provides improved fire support through a Precision Guided, Extended Range, fratricide reducing, accuracy enhancing, more lethal family of 155mm projectiles in support of Legacy to Objective forces.

## **ACQUISITION PHASE:**

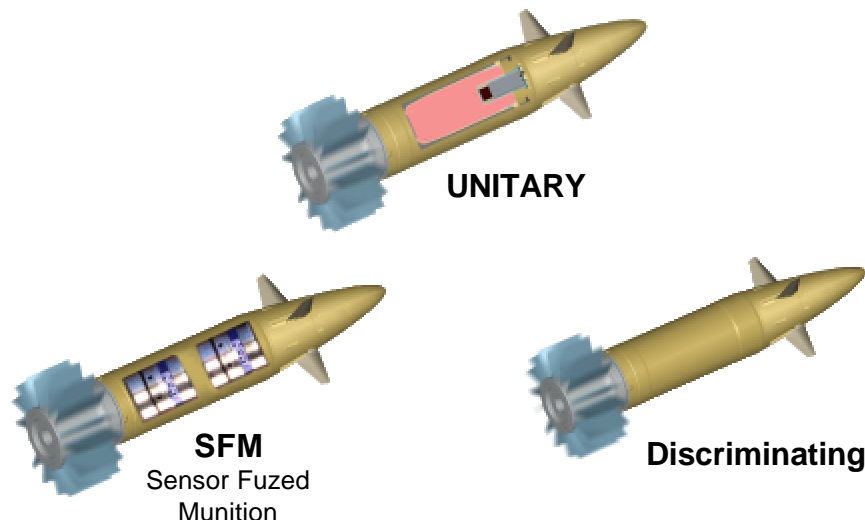
Currently: System Development & Demonstration

FY06: Unitary Milestone C

FY08: Unitary IOC

## **DESCRIPTION**

- Precision Guided, Extended Range Carrier for a Family of 155mm Cannon Ammunition
- Legacy to Objective Force System
- All Weather, Day and Night, Fire & Forget, Urban & Complex Terrain
- Objective Maximum Range: 50 km
- GPS-Inertial Navigation System Guidance w/ Anti-Jam Tech
- Increased Accuracy (150-4000%)
  - 10-20 meter Circular Error Probable (CEP) at all Ranges
  - Precision Delivery Decreases Collateral Damage
  - Decreases Volume of Fire Per Engagement
- Evolutionary Development through Block Approach



## **PRIME CONTRACTOR:**

- Raytheon Missile Systems (Tucson, Az)

### **Key Subs:**

- Bofors Defence (UDLP) Teamed with Raytheon
- GD-OTS: Unitary Payload and Projectile Body
- GD Versatron: Control Actuator System (CAS)
- L3: GPS & Inertial Measurement Unit (IMU)
- L3 KDI: Unitary Proximity Fuze / Projectile Fuze Safe & Arm
- Alliant Tech: Data Hold Battery
- Eagle Picher: System Battery



# Excalibur Industry Team



## Raytheon - System Prime

(Guidance, Navigation & Control)

**General Dynamics  
Ordnance & Tactical Systems**  
(Airframe)

**Bofors**  
(Airframe/ Base)

### Major Guidance System Sub's

#### **L3 - IEC**

(GPS Receiver)

(Inertial Measurement Unit - IMU)

#### **White Electronics Design Corp.**

(GPS SAASM & Production)

#### **Micropulse**

(GPS Antennas)

#### **L3 - KDI Precision Products**

(HOB/PD/Delay Fuze)

#### **Eagle Picher**

(System Battery)

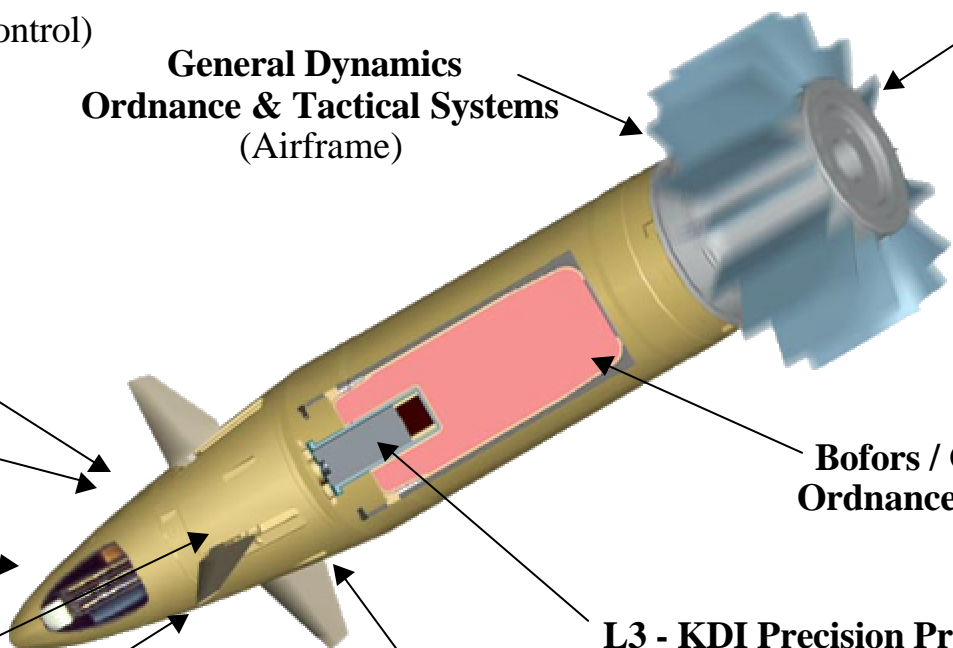
#### **Alliant TechSystems**

(Data Hold Batteries)

**Bofors / General Dynamics  
Ordnance & Tactical Systems**  
(Payload)

**L3 - KDI Precision Products**  
(Fuze Safe & Arm)

**General Dynamics  
Ordnance & Tactical Systems - Versatron**  
(Canard Control Actuators)



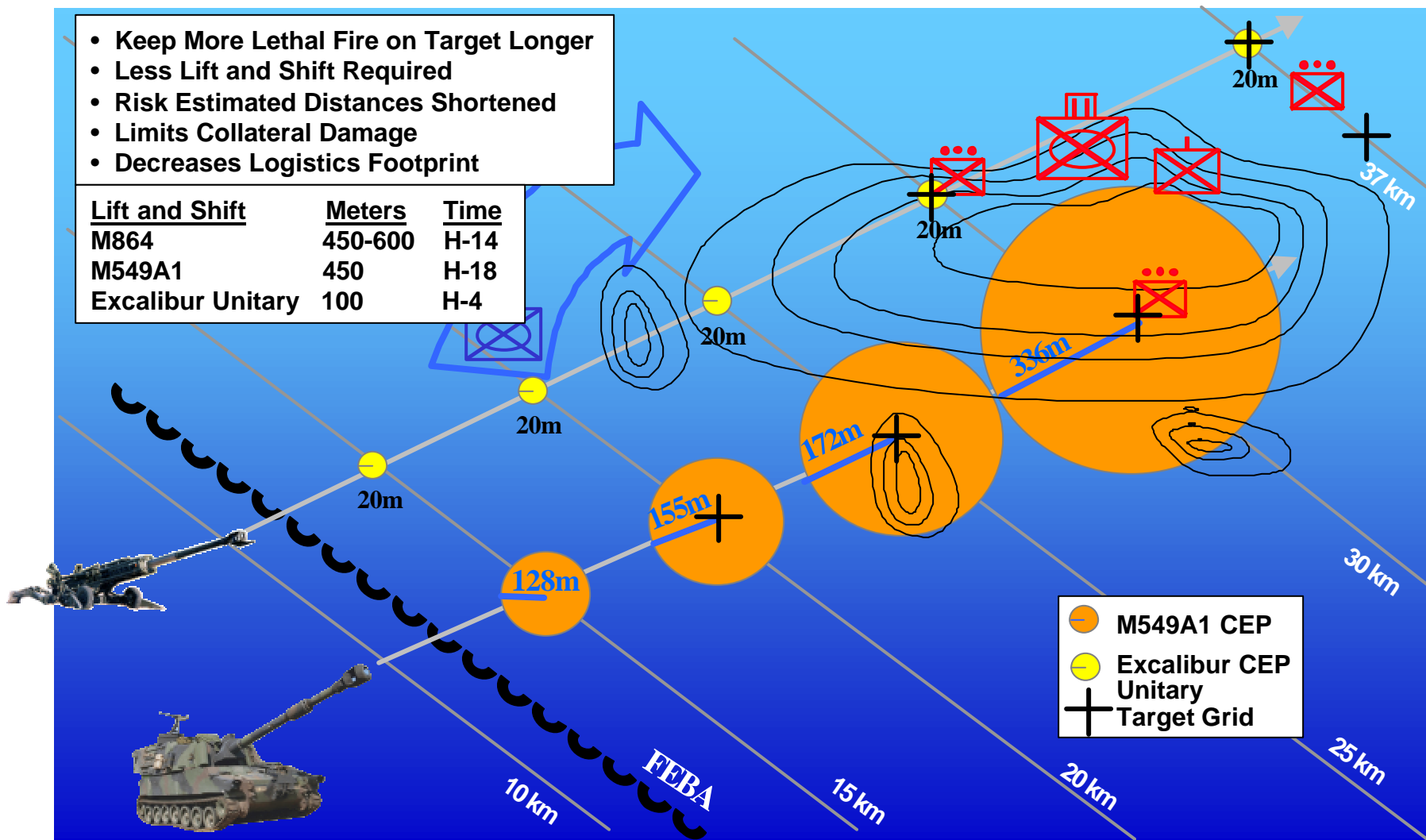


# The Benefits of Accuracy



- Keep More Lethal Fire on Target Longer
- Less Lift and Shift Required
- Risk Estimated Distances Shortened
- Limits Collateral Damage
- Decreases Logistics Footprint

<u>Lift and Shift</u>	<u>Meters</u>	<u>Time</u>
M864	450-600	H-14
M549A1	450	H-18
Excalibur Unitary	100	H-4







# Excalibur/TCM Merger



## What is TCM:

- Cooperative Program with Kingdom of Sweden (KoS) to Develop Extended Range, Precision-guided, 155mm Projectile

## Why Merge:

- Programs are complementary
  - Excalibur guidance & control
  - TCM Airframe & folding fins with base bleed
- Army can't afford to fund both programs through SDD
- Strong Congressional support for merger
- KoS has committed to provide funding

**Trajectory  
Correctable  
Munitions**

## Status:

- Implementation started Nov 01
- Merger Kick-off April 02 (US-PEO, FMV, RMS, BD)
- Trade studies selected projectile design, May 02
- Alpha contracting ongoing, Kickoff 12 June 02
- Preparing International Documentation – MOA
- Contract award planned for Oct 02

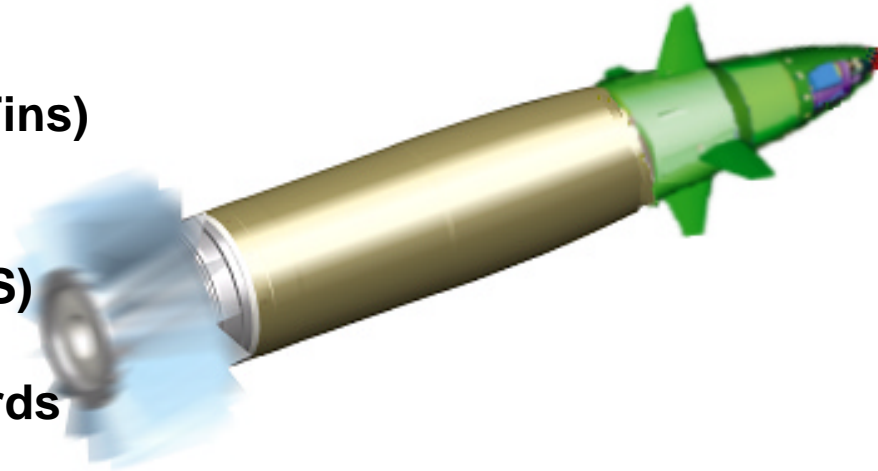


# Trade Study Results



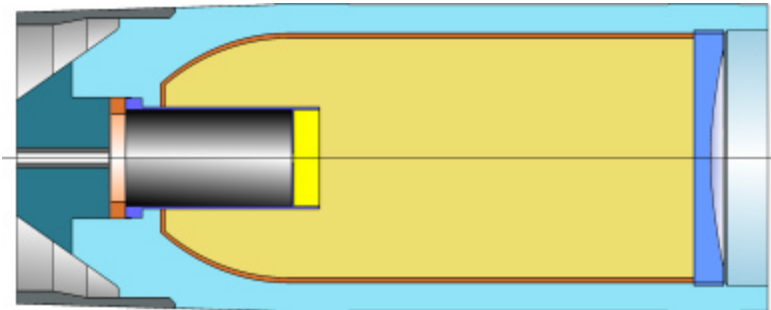
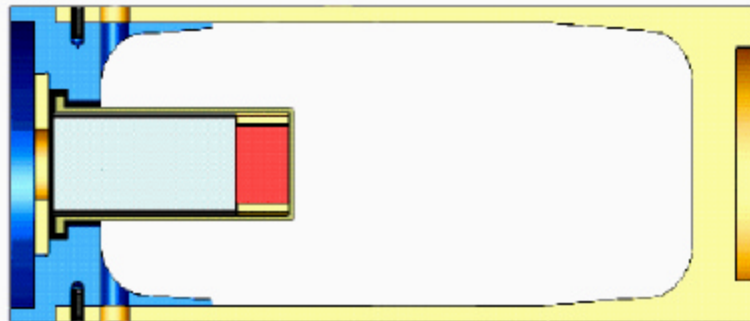
## Selected Configuration:

- TCM Aft Section (Free Spinning Base Fins)
- Base Bleed
- Hybrid roll controlled airframe:
  - 4 axis canard Actuation System (CAS)
  - CAS is close to the payload
  - GNC Electronics in front of the canards



## Payload Design Concept:

- Fuze forward, single wall casing





# GNC Technical Progress



## •GPS Dynamic Acquisition Test

- Demonstrated Integrated GPS Acquisition & Track up to 4 Hz
- L-3 (IEC) SAASM design approved by JPO
- SAASM obtained NSA approval for Tamper Resistant Coating

## •Inertial Measurement Unit (IMU)

- Meets ALL electrical performance requirements - bench
- Demonstrated Mechanical Performance to mid-zone G-levels

## •Live GNC – “Hot Battery Test”

- Successfully tested fully integrated GNC configuration powered by tactical battery

## •Canard Actuator System

- Passed Gun Launch at PIMP+5%
- Passed static canard deployment test

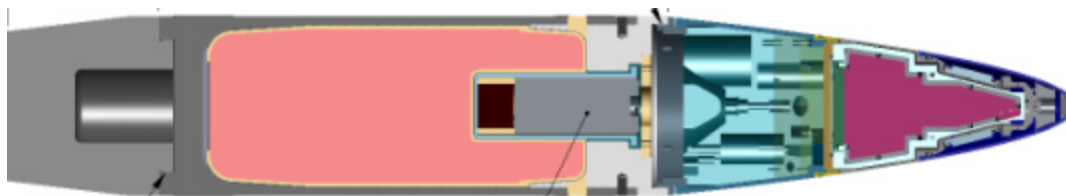
## •Software

- Formal Qualification Testing Complete for initial flights





# Payload Technical Progress



## Accomplishments

- Natural Frag warhead arena test completed
- Setback simulator testing begun
- Raytheon, GD, and ARDEC lethality models calibrated
- Full-scale warhead sled test
  - Perforated 8" 2X reinf concrete
- Selected forward-fuze warhead design concept

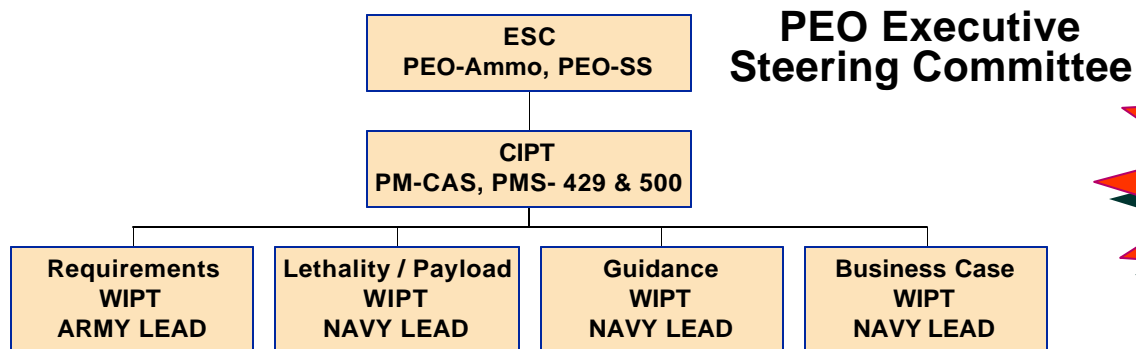
## Plan

- Continue forward-fuze design
- JMEM and 100% frag capture arena tests, Aug 02
- Full-scale sled testing with live and inert warheads, Aug 02





# Army-Navy Cooperation



**Well Established  
Working  
relationships**

## • Objectives

- ✓ Examine Requirements for Potential Adjudication / CAIV Opportunities
- ✓ Optimize GN&C Design and Component Commonality for CAIV Opportunities
- ✓ Identify Common Target Sets and Lethality/Effectiveness Criteria
- ✓ Evaluate Business Case for Second Source Investment and Payback Opportunities

## • Accomplishments

- ✓ Cost Avoidance of over \$50M
- ✓ Established Common Target Set
- ✓ Standardizing Lethality Modeling and Simulation Methodology
- ✓ Recommended Standard Payload / Defeat Criteria
- ✓ Standardized Arena Testing

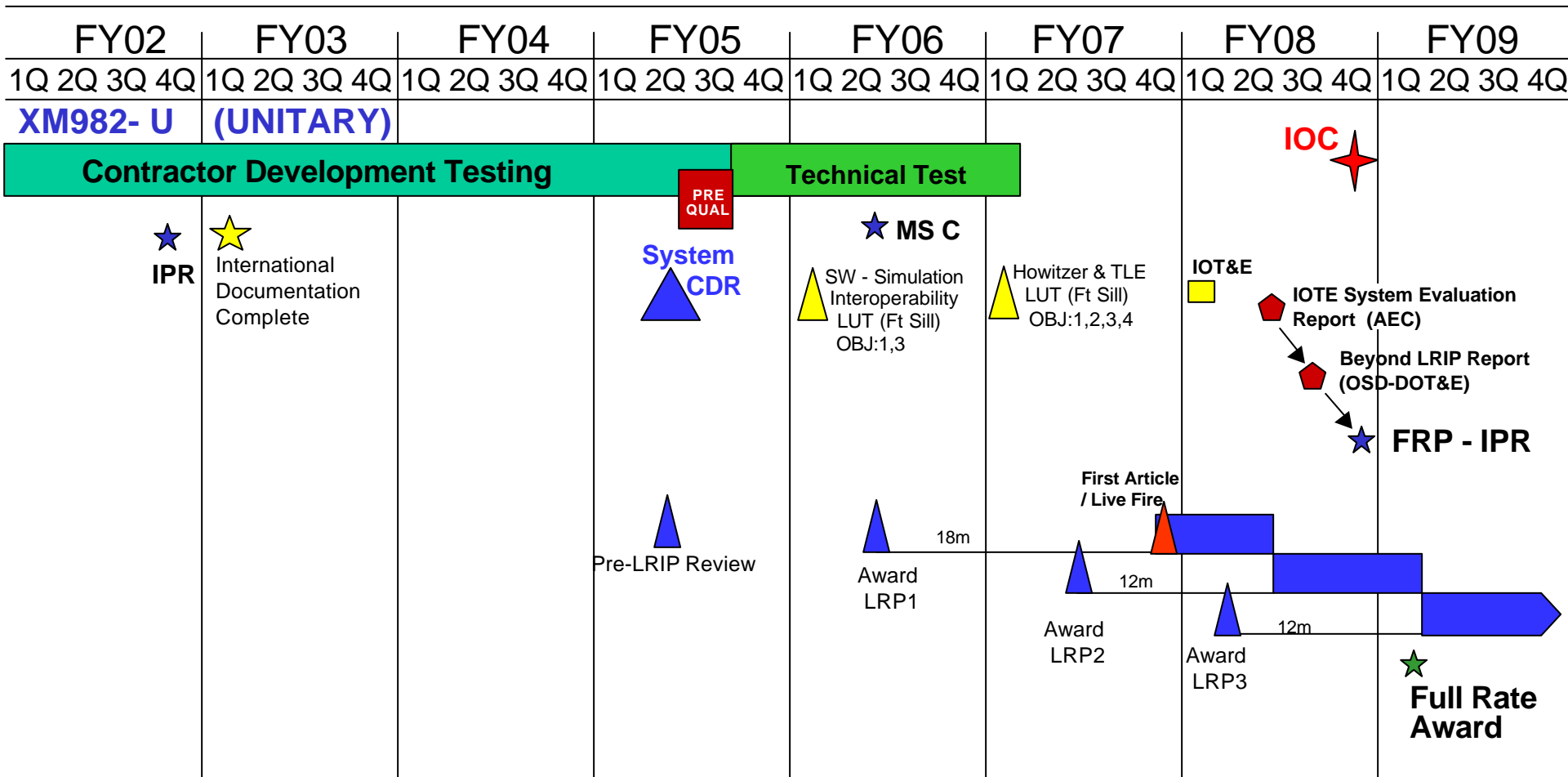
**Bi-Annual  
Reviews  
With OSD**





# Excaltbur/TCM Merged Unitary

## Block 1 Schedule - IOC FY08





# Summary



- **Excalibur transforms Legacy and Interim Forces through improved precision, range, reduced collateral damage and logistics footprint**
- **Excalibur is a possible Objective Force munitions solution and a precision guidance technology carrier**
- **Merging with Trajectory Correctable Munitions (TCM) program**